Safety-Kleen Oil Recovery Company

PCB Destruction Program

Demonstration Test Plan

June 21, 1993

Safety-Kleen Oil Recovery Company (SKORC) owns and operates a used oil re-refinery in East Chicago, Indiana. Currently, SKORC processes approximately 85 million gallons of used oils through the re-refinery annually. On November 13, 1992, SKORC submitted a permit application to USEPA Region V seeking approval to process PCB contaminated materials through the re-refinery. PCB contamination will be destroyed in the hydrotreating step of the re-refining process.

In November, 1992, Safety-Kleen received approval from the Ontario Ministry of the Environment (MOE) to process PCB contaminated material through Safety-Kleen's re-refinery in Breslau, Ontario. During a four-week period in November and December of 1992, Safety-Kleen processed approximately 200,000 gallons of PCB contaminated material through the Breslau re-refinery. A comprehensive sampling program maintained throughout the processing program demonstrated that PCB contamination was, in fact, destroyed in the hydrotreating step of the re-refining process. Included, as Appendix A, is a summary of the PCB processing program conducted by Safety-Kleen at its Breslau, Ontario re-refinery.

Included herein are details of SKORC's test program for the company's East Chicago, Indiana re-refinery. The program is designed to demonstrate that PCB contamination in used oil is destroyed in the re-refining process.

I. General Process Description

All incoming waste materials are tested upon receipt in accordance with SKORC's Waste Analysis Plan. Once the material has been tested and received at the re-refinery, it is introduced into a four-stage distillation system. The first stage of this system, dehydration, removes the wastewater and any light hydrocarbon contamination. PCB contamination will remain in the dehydrated oil. The waste water generated in the rerefining process is treated further in a light ends recovery tower (LERT). This tower separates any light fuels which may still be in solution with the water and any ethylene glycol which is present.

The fuel cut is combined with the light hydrocarbons separated in the dehydration stage. The ethylene glycol bottoms stream is segregated for treatment at an outside facility.

The dehydrated oil passes to a second, more severe, distillation step where the remaining fuel oils (light hydrocarbons) are removed using vacuum distillation. These fuel oils are condensed as overhead vapors. Some PCB contamination may occur in the VFS fuel streams. SKORC will segregate these fuel streams, and test them in accordance with the Demonstration Test Plan Sampling Program (Attachment IV). If contamination is detected, the fuel streams will be re-introduced into the plant feed stream, or further treated by hydrodechlorination to destroy the PCBs.

The third distillation stage occurs in the vacuum tower which operates at a lower vacuum and higher temperatures than the vacuum fuel stripper. Defueled oil (including any PCB contamination) from the vacuum fuel stripper is pumped to the vacuum distillation tower. Upon entry to the tower, the initial lubrication oil fraction is vaporized and recovered. The remaining oil stream is then transferred to the fourth distillation stage. The fourth distillation stage is thin film evaporation, utilizing two thin film evaporators. In the two thin film evaporators, the oil flows down the inside of a double pipe heat exchanger, rotating blades spread the material against the wall of the exchanger to maximize heat transfer. These evaporators produce two grades of lubricating oil (a medium and heavy fraction).

The distillation operations at East Chicago produce three grades of lubricating base stocks (light, medium, and heavy). PCB contamination tends to concentrate in the medium lube oil fraction. However, low levels of PCB contamination will also be found in the light and heavy fractions. The analytical data generated during the PCB processing program in Breslau Ontario indicates the anticipated contamination levels in the various distillation products. A brief summary of data generated in Breslau showing the concentration of PCBs in the fractions is included as Appendix A. Attachment I indicates the anticipated contamination of PCBs in the process fractions at SKORC.

All lubricating oil fractions and PCB contaminated fuel fractions produced through distillation are segregated and stored prior to further treatment by catalytic hydrotreatment. In the catalytic hydrotreater, lubricating oils are subject to high temperature, high pressure, catalyzed reactions in a hydrogen atmosphere. Hydrogen replaces the chlorine in the PCB molecule. The hydrodechlorination of PCB's can be expressed by the following chemical reaction:

$$C_6H_3Cl_3 \quad + \quad 6H_2 \quad \_ \quad C_6H_{12} \quad + \quad 3HCl$$

II. Hydrodechlorination Compared to Incineration

Currently, the only disposal option available in the United States for waste oils, oily waters, and other hydrocarbons contaminated with PCBs is commercial incineration. Although a metallic sodium process is available to destroy PCBs in a hydrocarbon matrix, the presence of water and other contaminants in waste materials may prohibit the use of the metallic sodium process. Several problems with incineration have been documented. For example, the chlorine atoms are effective flame retardants and tend to quench the hydrogen-free radicals which propagate the reactions in the incinerator. Therefore, complete combustion is difficult to achieve. The greatest concern of incomplete combustion is formation of phosgene, dioxins, or other toxins more dangerous than the original waste being incinerated. Removing these toxic materials from stack gases can be a very difficult task and represents a unique disposal problem in itself. The hydrodechlorination reaction proposed by SKORC is a reduction reaction and not an oxidation reaction. Therefore, by-products such as the dioxins or the dibenzofuranes cannot be produced.

Advantages of catalytic hydrodechlorination of PCBs over incineration are summarized below:

1. Catalytic hydrodechlorination can be effective at much lower operating temperatures than incineration (approximately 350° C versus $1200\text{-}1600^{\circ}$ C).

2. The biphenol product remaining after hydrodechlorination will have value as a petroleum hydrocarbon.

3. All effluents from the hydrodechlorination reaction are in the liquid phase (or condensed to a liquid) and thus can be monitored much more closely than the gaseous effluent incinerator.

4. Destruction in the hydrotreater eliminates the potential for products of incomplete combustion, dioxins, dibenzolfluouranes, NO_x, CO, and CO_2. The mechanisms for the formation of dioxin from the combustion reactions are poorly understood, but it is obvious that a source of oxygen is needed. Hydrochlorination requires no supply of oxygen therefore, dioxins will not be produced.

III. Incorporation of SKORC's November 13, 1992, Permit Application

On November 13, 1992, SKORC submitted an application to the USEPA Region V requesting a permit to process PCB contaminated materials through its East Chicago re-refinery. SKORC's permit application included details of the following facility programs:

1. A detailed description of the re-refining process;
2. SKORC's Waste Analysis Plan;
3. SKORC's analytical procedures and laboratory QA/QC;
4. Facility Operating Logs;
5. Facility Inspection Plans;
6. SKORC's Safety Plans;
7. SKORC's RCRA Training Plan;
8. A copy of the facility's Spill Prevention Control and Countermeasure Plan;
9. SKORC's Closure Plan.

All these programs/plans are currently in place at SKORC's East Chicago Re-refinery, and information/programs described in these plans are incorporated into this demonstration test plan.

IV. Demonstration Test Plan - Waste Description

Safety-Kleen's East Chicago facility receives used oils, oily waters, and industrial waste waters from a variety of generators throughout the United States. SKORC has obtained a final hazardous waste TSDF permit from the Indiana Department of Environmental Management (IDEM) and the U.S. Environmental Protection Agency (USEPA), authorizing SKORC to receive and store specific waste materials that are classified as hazardous. As part of SKORC's hazardous waste permit, the facility has developed a Waste Analysis Plan (WAP) in accordance with the Resource Conservation and Recovery Act (RCRA). The WAP describes the analytical procedures used to identify, segregate, and process wastes received at the East Chicago facility. A copy of the facility's most current WAP is included in the permit application submitted November 13, 1992.

Safety-Kleen is seeking approval pursuant to the Toxic Substances Control Act (TSCA) to process used oils, oily waters, and other waste streams described in the facility's approved WAP, when these streams are contaminated with regulated levels of PCBs. SKORC will segregate PCB contaminated materials from non-PCB contaminated materials in aboveground storage tanks prior to processing. All storage tanks at SKORC's East Chicago facility that may be used to store PCB contaminated materials meet the technical requirements established for the storage of PCB wastes from 40 CFR 761.65. All storage tanks are constructed of carbon steel, and located within secondary containment. All tanks are equipped with a high-level alarm, and to ensure the tanks are in good condition, SKORC conducts inspections of the tanks in accordance with the facility's hazardous waste storage permit. The tanks are inspected daily in accordance with Safety-Kleen's approved RCRA inspection plan.

Safety-Kleen plans to feed PCB contaminated materials directly from the PCB guard tank to the discharge of the feed-tank pump. In the feed line to the re-refinery, PCB contaminated materials will mix with noncontaminated materials from the facility feed-tank. The mixing ratio (contaminated oil to uncontaminated oil) will depend on specific characteristics of the PCB contaminated material. However, SKORC plans to feed the PCB contaminated material at a ratio such that the feed to the dehydrator will contain approximately 25 ppm PCBs.

The feed rate to the re-refining process is indicated by flow indicated FI-201. The feed rate to the dehydrator is approximately 150 - 200 gpm. FI-201 is a continuous monitoring device which determines flow by measuring the differential pressure across a specific size orifice plate and translating this data to a gallons/minute readout. The readout is indicated, and monitored, at the TDC 3000 control console in the re-refinery control room.

Controlled mixing into the dehydration feed stream will ensure a homogenous feed to the rerefinery. Flow rates into the dehydrator and samples of the feed streams will be used to determine the PCB loading. Completion of the PCB processing will be determined upon flushing the system with noncontaminated material until the level PCBs in the feed stream and all product streams are nondetectable (i.e., less than 2 ppm). Flow rates, anticipated volumes, and run time duration is listed in Attachment II.

At the present time, SKORC has 46,664 gallons of PCB contaminated material in storage at the East Chicago facility. This material was received from Safety-Kleen's branch collection network, and includes all decontamination flush oil. This volume is at a concentration of approximately 26 ppm (dry weight), and SKORC proposes to use this material to conduct the Decontamination Test Plan. In order to conduct a thorough demonstration and ensure that adequate data is developed, SKORC proposes to process enough material to completely destroy all PCBs and thoroughly flush the re-refining process vessels, piping, and associated tankage.

V. Demonstration Test Plan - Monitoring/Sampling Program

To ensure destruction of the PCB molecules, SKORC is proposing a comprehensive sampling program that will be implemented during the demonstration test period. Attachment III summarizes the location of each sample point and provides a brief description of each location and the sampling frequency. The approximate location of each sampling point is identified on Attachment IV.

Safety-Kleen's sampling program will monitor all streams generated by the re-refining process, beginning at the point of generation and continuing through the storage of the products and by-products. The sampling program is designed to track PCB contamination through the re-refining process and demonstrate that the contamination is destroyed in the hydrotreater.

The number of samples taken will vary depending on the amount of contaminated material being processed, and the feed rate of the contaminated material due to the dehydrator. Using the contaminated material currently in storage at East Chicago, processing will be completed within 24-36 hours, and involve analysis of over 60 samples.

V. Conclusion

Safety-Kleen Oil Recovery Company (SKORC) has applied to the U.S.EPA for a permit to process PCB contaminated materials through its used oil rerefinery in East Chicago. A similar processing program conducted by Safety-Kleen at its Breslau, Ontario rerefinery in 1992 indicates that PCB contamination in used oil will be destroyed in the hydrotreating stage of the rerefining process. SKORC plans to use the same processing technology to destroy PCB contamination in used oils at its East Chicago facility, and recover the oil portion for beneficial reuse.

The purpose of this Demonstration Test Plan is to process a limited amount of PCB contaminated oils to ensure that the rerefining process in East Chicago destroys the PCB contamination. The PCB processing program will be conducted under strict process monitoring and a comprehensive sampling/analysis program will track the PCB contamination through the rerefining process and demonstrate its destruction.

ATTACHMENT I

PCB DISTRIBUTION
(Anticipated Concentration)

	ppm PCB
Used Oil Feed (Combined)	25
Dehydration Overheads	< 2
LERT Bottoms	< 2
Vacuum Fuel Stripper Overheads	20
V330 - Light Vacuum Oil	58
FE301 - Medium Vacuum Oil	20
FE302 - Heavy Vacuum Oil	10
Asphaltic Bottoms	<.5
Hydrotreater Feed Light Oil	58
Hydrotreater Feed Medium Oil	15
Hydrotreater Distillate Fuel	<.5
Hydrotreater Rundown Product	N.D.
Process Waters	< 2.5 ppb

*Revised: 06/18/93
oper/lotus93/reports/pcbdistrb.wk3

ATTACHMENT III

SAMPLING PROGRAM

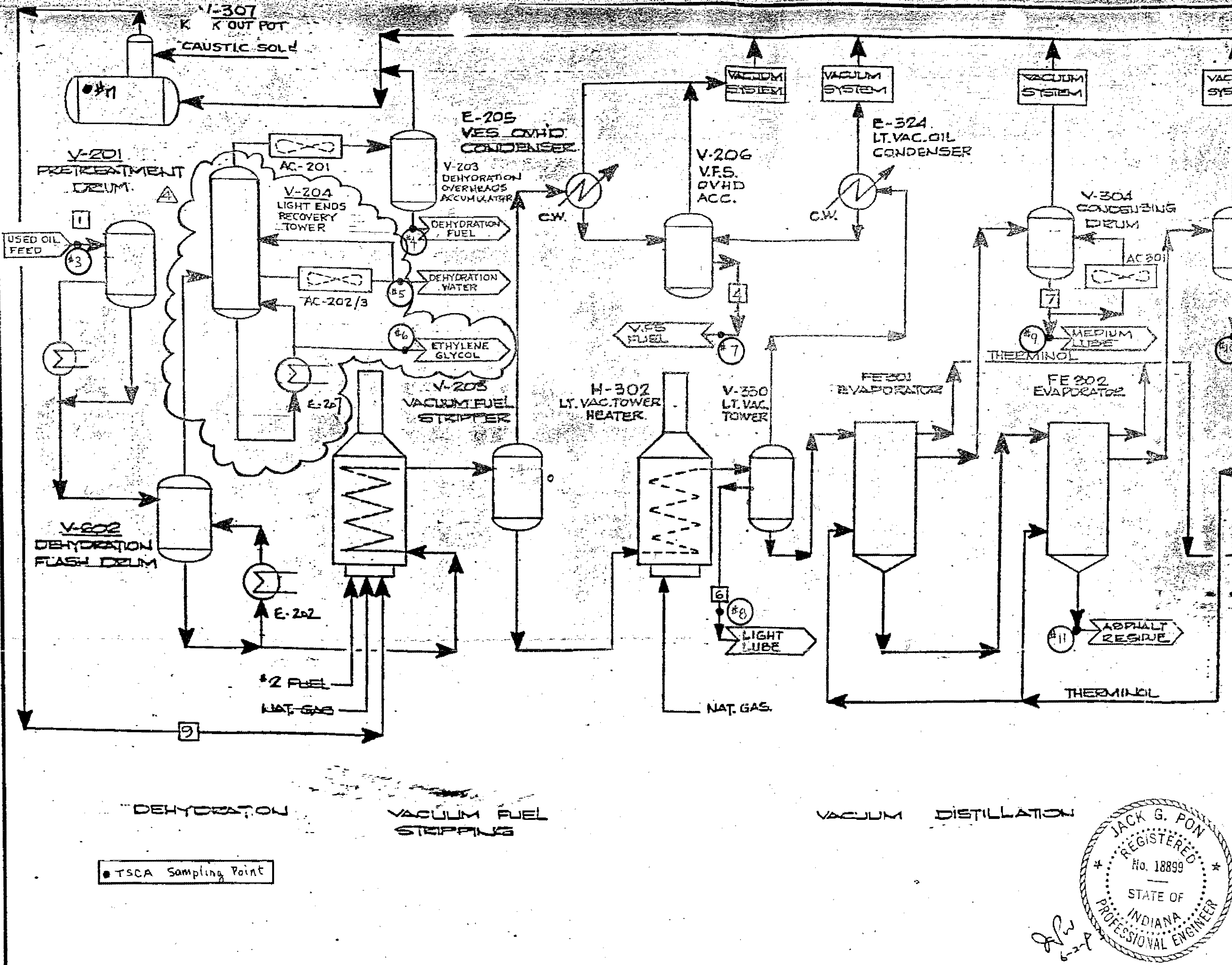
SAMPLING FREQUENCY AND ANALYSES

Sample # and I.D.	Sampling Frequency	Sampling Method	Analysis	Acceptable PCB Limits
1. Waste Receipt	Each Shipment	Coliwasa	PCB, Chlorinated Solvents	RCRA TSD Permit Limits
2. Receiving Guard Tank	Each Guard Tank (27,000 g)	Composite of all receipts in tank	PCB's	NA
3. Feed to Pretreatment V-201	Sample 4 times daily while processing PCB materials	Grab Sample	PCB's	NA. Used to determine PCB loading to dehydration.
4. V203 - Dehydration Overheads Receiver	Sample 2 times daily while processing PCB materials. Add'l grab tank sample at end of each batch.	Grab Sample	PCB's	PCB's <2 ppm
5. V204 - LERT Dehydration Water	Sample 2 times daily Add'l grab tank sample at end of each batch.	Grab Sample	PCB's	PCB's <2 ppb
6. V204 - LERT Bottoms	Sample 2 times daily Additional grab tank sample at end of each batch.	Grab Sample	PCB's	PBC's <2 ppm
7. V206 VFS Overhead (Fuel)	2 times daily Add'l grab tank sample at end of each batch.	Grab Sample	PCB's	<2 ppm
8. Lite Vacuum Oil Rundown V - 330	Sample 2 times daily while processing PCB Materials.	Grab Sample	PCB's	NA
9. Medium Vacuum Oil Rundown V-304	Sample 2 times daily while processing PCB materials.	Grab Sample	PCB's	NA

Sample # and I.D.	Sampling Frequency	Sampling Method	Analysis	Acceptable PCB Limits
10. Heavy Vacuum Oil Rundown V - 305	Sample 2 times daily while processing PCB materials.	Grab Sample	PCB's	NA
11. Luwa Bottoms Rundown	Sample 2 times daily while processing PCB materials. Addt'l grab tank sample at end of each batch.	Grab Sample	PCB's	PCB's <5 ppm
12. Feed to Hydrotreater	Sample 2 times daily while processing PCB materials	Grab Sample	PCB's	NA
13. Feed to R403/R404	Sample 2 times daily while processing PCB materials	Grab Sample	PCB's	NA
14. R403 Outlet	Sample 2 times daily while processing PCB materials	Grab Sample	PCB's	NA
15. Hydrotreater	Sample four times daily while processing PCB materials. Addt'l grab tank sample at end of each batch.	Grab Sample	PCB's	PCB'S n.d. <2 ppm
16. V405 - Kerosene Rundown	Sample four times daily while processing PCB materials. Add'l sample at end of each batch.	Grab Sample	PCB's	PCB's n.d. <2 ppm
17. V-307 Caustic Solution	Sample 2 times daily while processing PCB materials.	Grab Sample	PCB's	PCB's n.d. <2 ppm
18. V-407 Spent Caustic	Sample 2 times daily while processing PCB materials.	Grab Sample	PCB's	PCB's n.d. <2 ppm

ATTACHMENT IV

SAMPLING LOCATIONS

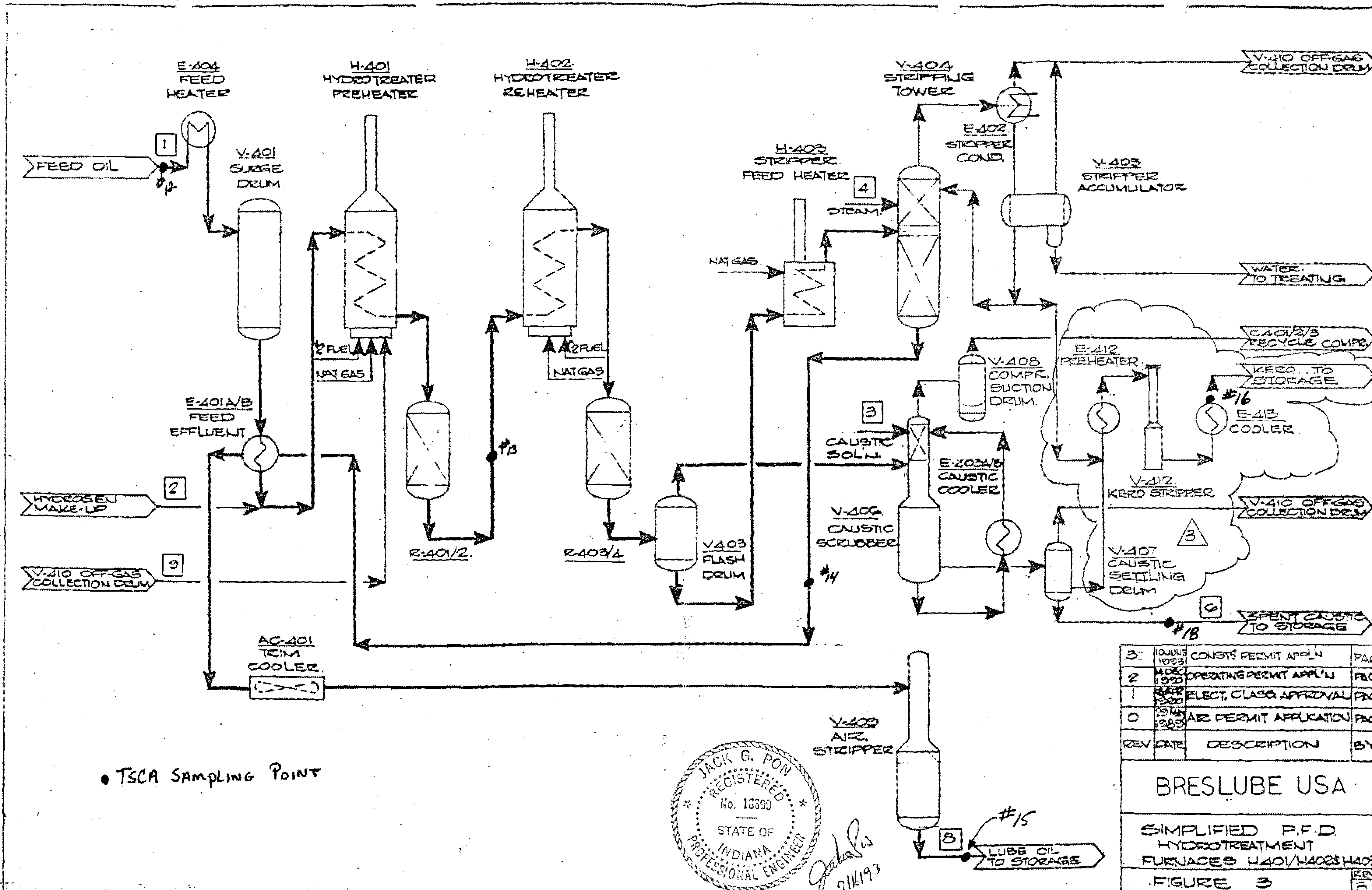


REV	DATE	DESCRIPTION	BY
4	6-2-93	EXIST. APP'D.-PRNT. SIMPLIFIED PFD	MSH
3	9 OCT 91	H-302, E-324 AND V-330 ADDED	P.S
2	14 FEB 1990	OPERATING PERMIT APPLN E-212 WAS E-206	PAC
1	18 APR 1990	ELECT. CLASS. APPROVAL	PAC
0	21 JAN 90	AIR PERMIT APPLICATION	PAC

BRESLUBE USA

SIMPLIFIED P.F.D
DISTILLATION
FURNACES #-201, 301 & 302

FIGURE 2. | 4


E-404 FEED HEATER
H-401 HYDROTREATER PREHEATER
H-402 HYDROTREATER REHEATER
V-404 STRIPPING TOWER
V-410 OFF-GAS COLLECTION DRUM
FEED OIL
#12
V-401 SURGE DRUM
H-403 STRIPPER FEED HEATER
E-402 STRIPPER COND.
V-405 STRIPPER ACCUMULATOR
STEAM
NAT GAS
WATER TO TREATING
1/2 FUEL
NAT GAS
C-401/2/3 RECYCLE COMPR.
E-412 PREHEATER
V-408 COMPR. SUCTION DRUM
KERO. TO STORAGE
#16
E-413 COOLER
E-401A/B FEED EFFLUENT
#13
CAUSTIC SOL'N
E-403A/B CAUSTIC COOLER
V-412 KERO STRIPPER
HYDROGEN MAKE-UP
V-406 CAUSTIC SCRUBBER
V-410 OFFGAS COLLECTION DRUM
R-401/2
R-403/4
V-403 FLASH DRUM
V-407 CAUSTIC SETTLING DRUM
V-410 OFF-GAS COLLECTION DRUM
#14
SPENT CAUSTIC TO STORAGE
#18
AC-401 TRIM COOLER
V-409 AIR STRIPPER
• TSCA SAMPLING POINT
JACK G. PON REGISTERED No. 13399 STATE OF INDIANA PROFESSIONAL ENGINEER
7/16/93
#15
LUBE OIL TO STORAGE
3 | 10 JUNE 1993 | CONST. PERMIT APPL'N | PAC
2 | 14 DEC 1990 | OPERATING PERMIT APPL'N | PAC
1 | 1990 | ELECT. CLASS. APPROVAL | PAC
0 | 29 MAY 1989 | AIR PERMIT APPLICATION | PAC
REV | DATE | DESCRIPTION | BY
BRESLUBE USA
SIMPLIFIED P.F.D. HYDROTREATMENT FURNACES H401/H402 & H403
FIGURE 3
REV 3